Aluminum electrolytic capacitors

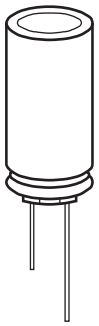
Single-ended capacitors

Series/Type: **B41856**

Date: December 2016

EPCOS AG is a TDK Group Company.

Long-life grade capacitors



Applications

- For use in output circuits of switch-mode power supplies of compact design
- For professional industrial electronics, telecommunications and data processing equipment

Features

- Very low impedance at high frequency
- Low ESR
- High ripple current capability
- RoHS-compatible

Construction

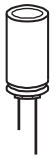
- Radial leads
- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Minus pole marking on the insulating sleeve
- Case with safety vent

Delivery mode

Terminal configurations and packing:

- Bulk
- Taped, Ammo pack
- Cut
- Kinked
- PAPR (Protection Against Polarity Reversal): crimped leads, J leads, bent leads

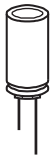
Refer to chapter "Single-ended capacitors – Taping, packing and lead configurations" for further details.



Specifications and characteristics in brief

Rated voltage V_R Surge voltage V_S	16 ... 100 V DC 1.15 · V_R						
Rated capacitance C_R Capacitance tolerance	22 ... 2200 µF ±20% ≙ M						
Dissipation factor tan δ (20 °C, 120 Hz)	For capacitance higher than 1000 µF add 0.02 for every increase of 1000 µF.						
	V_R (V DC)	16	25	35	50	63	100
	tan δ (max.)	0.16	0.14	0.12	0.10	0.10	0.08
Leakage current I_{leak} (20 °C, 5 min)	$I_{leak} = 0.01\ \mu A \cdot \left(\frac{C_R}{\mu F} \cdot \frac{V_R}{V}\right)$						
Self-inductance ESL	Diameter (mm)	8 ... 12.5	16	18			
	ESL (nH)	20	26	34			
Useful life[1)] 105 °C; V_R; $I_{AC,R}$	> 2000 h for d = 8 mm > 3000 h for d = 10 mm > 4000 h for d ≥ 12.5 mm						
Requirements	|ΔC/C| ≤ 40% of initial value tan δ ≤ 3 times initial specified limit I_{leak} ≤ initial specified limit						
Voltage endurance test 105 °C; V_R	2000 h for d = 8 mm 3000 h for d = 10 mm 4000 h for d = 12.5 mm						
Post test requirements	|ΔC/C| ≤ 30% of initial value tan δ ≤ 2 times initial specified value I_{leak} ≤ initial specified limit						
Vibration resistance test	To IEC 60068-2-6, test Fc: Frequency range 10 Hz ... 2 kHz, displacement amplitude max. 0.75 mm, acceleration max. 10 *g,* duration 3 × 2 h. Capacitor rigidly clamped by the aluminum case.						
IEC climatic category	To IEC 60068-1: 40/105/56 (−40 °C/+105 °C/56 days damp heat test)						
Sectional specification	IEC 60384-4						

1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



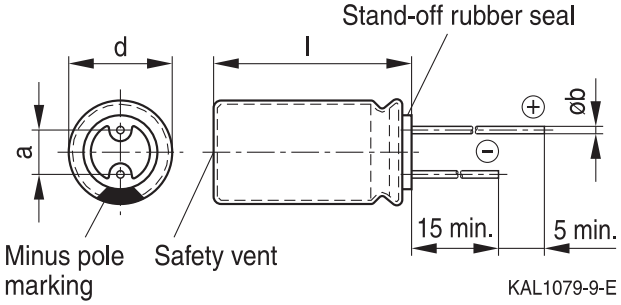
B41856

Low impedance – 105 °C

Dimensional drawings

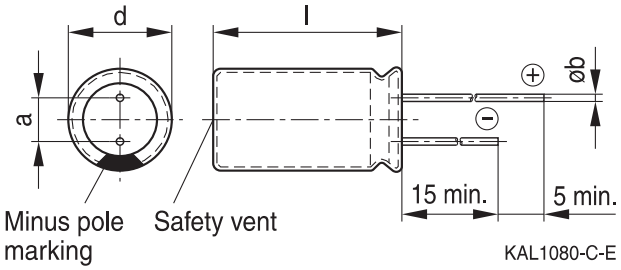
With stand-off rubber seal

Diameters (mm): 10, 12.5, 16, 18



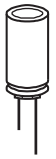
With flat rubber seal

Diameter (mm): 8



Dimensions and weights

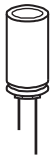
Dimensions (mm)				Approx. weight
d +0.5	l	a ±0.5	b	g
8	11.5 +1.5	3.5	0.60 ±0.05	1.0
10	12.5 +1.0	5.0	0.60 ±0.05	1.6
10	16 +1.0	5.0	0.60 ±0.05	1.9
10	20 +2.0	5.0	0.60 ±0.05	2.6
12.5	20 +2.0	5.0	0.60 ±0.05	3.6
12.5	25 +2.0	5.0	0.60 ±0.05	4.5
16	20 +2.0	7.5	0.80 ±0.05	5.5
16	25 +2.0	7.5	0.80 ±0.05	7.5
16	31.5 +2.0	7.5	0.80 ±0.05	7.8
18	20 +2.0	7.5	0.80 ±0.1	8.0
18	25 +2.0	7.5	0.80 ±0.1	9.0
18	31.5 +2.0	7.5	0.80 ±0.1	11.0
18	35 +2.0	7.5	0.80 ±0.1	13.0



Overview of available types

Other voltage and capacitance ratings are available upon request.

V_R (V DC)	16	25	35	50	63	100
	Case dimensions d × l (mm)					
C_R (µF)						
22						8 × 11.5
33						8 × 11.5
47						10 × 12.5
68					8 × 11.5	10 × 16
100			8 × 11.5	8 × 11.5	8 × 11.5 10 × 12.5	10.0 × 20
150					10 × 16	12.5 × 20
220	8 × 11.5	8 × 11.5	10 × 12.5	10 × 16	10 × 20	16 × 20
330	8 × 11.5	10 × 12.5	10 × 16	10 × 20	12.5 × 25	16 × 25 18 × 20
470	10 × 12.5	10 × 16	10 × 20	12.5 × 20	12.5 × 25 16 × 20	16 × 31.5 18 × 25
680	10 × 16	10 × 20	12.5 × 20	12.5 × 25	16 × 25 18 × 20	18 × 35
1000	10 × 20	12.5 × 20	12.5 × 25		16 × 31.5	
1200					18 × 31.5	
1500	12.5 × 20	12.5 × 25			18 × 35	
2200	12.5 × 25					



B41856

Low impedance − 105 °C

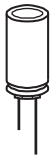
Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	Z_{max} 100 kHz −10 °C Ω	Z_{max} 100 kHz 20 °C Ω	$I_{AC,R}$ 100 kHz 105 °C mA	Ordering code (composition see below)
V_R = 16 V DC					
220	8 × 11.5	0.400	0.100	700	B41856C4227M***
330	8 × 11.5	0.400	0.100	700	B41856C4337M***
470	10 × 12.5	0.250	0.070	900	B41856C4477M***
680	10 × 16	0.180	0.055	1300	B41856C4687M***
1000	10 × 20	0.140	0.042	1500	B41856C4108M***
1500	12.5 × 20	0.099	0.030	2000	B41856C4158M***
2200	12.5 × 25	0.082	0.025	2300	B41856C4228M***
V_R = 25 V DC					
220	8 × 11.5	0.400	0.100	700	B41856C5227M***
330	10 × 12.5	0.250	0.070	900	B41856C5337M***
470	10 × 16	0.180	0.055	1300	B41856C5477M***
680	10 × 20	0.140	0.042	1500	B41856C5687M***
1000	12.5 × 20	0.099	0.030	2000	B41856C5108M***
1500	12.5 × 25	0.082	0.025	2300	B41856C5158M***
V_R = 35 V DC					
100	8 × 11.5	0.400	0.100	700	B41856C7107M***
220	10 × 12.5	0.250	0.070	900	B41856C7227M***
330	10 × 16	0.180	0.055	1300	B41856C7337M***
470	10 × 20	0.140	0.042	1500	B41856C7477M***
680	12.5 × 20	0.099	0.030	2000	B41856C7687M***
1000	12.5 × 25	0.082	0.025	2300	B41856C7108M***
V_R = 50 V DC					
100	8 × 11.5	0.600	0.150	600	B41856C6107M***
220	10 × 16	0.280	0.070	1100	B41856C6227M***
330	10 × 20	0.200	0.050	1300	B41856C6337M***
470	12.5 × 20	0.130	0.040	1700	B41856C6477M***
680	12.5 × 25	0.090	0.030	2100	B41856C6687M***

Composition of ordering code

*** = Version

- 000 = for standard leads, bulk
- 001 = for kinked leads, bulk (for d × l = 10 × 20 mm and ∅ 12.5 … 18 mm)
- 002 = for cut leads, bulk (for ∅ 10 ... 18 mm)
- 003 = for crimped leads, blister (for ∅ 16 … 18 mm)
- 004 = for J leads, blister (for ∅ 10 ... 18 mm)
- 006 = for taped leads, Ammo pack, lead spacing F = 3.5 mm (for ∅ 8 mm)
- 008 = for taped leads, Ammo pack, lead spacing F = 5.0 mm (for ∅ 8 ... 12.5 mm)
- 009 = for taped leads, Ammo pack, lead spacing F = 7.5 mm (for ∅ 16 mm and d × l = 18 × 20 … 18 × 31.5 mm)
- 012 = for bent 90° leads, blister (for ∅ 16 … 18 mm)



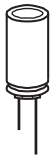
Technical data and ordering codes

C_R 120 Hz 20 °C µF	Case dimensions d × l mm	Z_{max} 100 kHz −10 °C Ω	Z_{max} 100 kHz 20 °C Ω	$I_{AC,R}$ 100 kHz 105 °C mA	Ordering code (composition see below)
V_R = 63 V DC					
68	8 × 11.5	1.080	0.207	500	B41856C8686M***
100	8 × 11.5	1.080	0.207	500	B41856C8476M***
100	10 × 12.5	0.600	0.150	690	B41856C8107M***
150	10 × 16	0.400	0.100	950	B41856C8157M***
220	10 × 20	0.300	0.075	1150	B41856C8227M***
330	12.5 × 25	0.123	0.041	1900	B41856C8337M***
470	12.5 × 25	0.123	0.041	1900	B41856C8477M***
470	16 × 20	0.126	0.042	2000	B41856D8477M***
680	16 × 25	0.099	0.033	2600	B41856C8687M***
680	18 × 20	0.117	0.039	2500	B41856D8687M***
1000	16 × 31.5	0.081	0.027	2850	B41856C8108M***
1200	18 × 31.5	0.078	0.026	3300	B41856C8128M***
1500	18 × 35	0.069	0.023	3400	B41856C8158M***
V_R = 100 V DC					
22	8 × 11.5	1.440	0.360	355	B41856C9226M***
33	8 × 11.5	1.440	0.360	355	B41856C9336M***
47	10 × 12.5	0.680	0.170	480	B41856C9476M***
68	10 × 16	0.440	0.110	600	B41856C9686M***
100	10.0 × 20	0.336	0.084	800	B41856C9107M***
150	12.5 × 20	0.186	0.062	1100	B41856C9157M***
220	16 × 20	0.144	0.048	1350	B41856C9227M***
330	16 × 25	0.114	0.038	1700	B41856C9337M***
330	18 × 20	0.135	0.045	1500	B41856D9337M***
470	16 × 31.5	0.096	0.032	1850	B41856C9477M***
470	18 × 25	0.108	0.036	1750	B41856D9477M***
680	18 × 35	0.081	0.027	2200	B41856C9687M***

Composition of ordering code

*** = Version

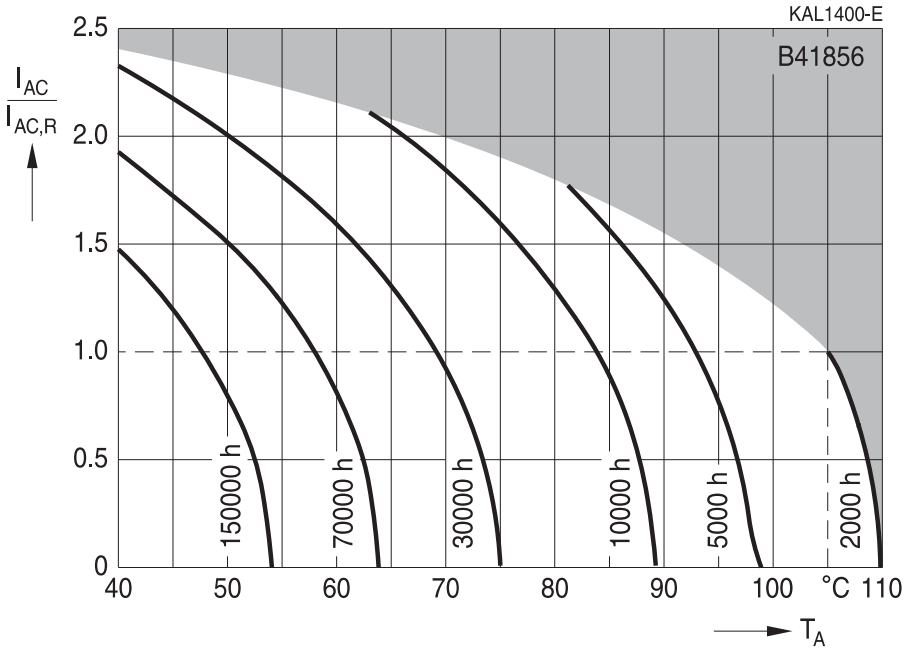
- 000 = for standard leads, bulk
- 001 = for kinked leads, bulk (for d × l = 10 × 20 mm and ∅ 12.5 … 18 mm)
- 002 = for cut leads, bulk (for ∅ 10 ... 18 mm)
- 003 = for crimped leads, blister (for ∅ 16 … 18 mm)
- 004 = for J leads, blister (for ∅ 10 ... 18 mm)
- 006 = for taped leads, Ammo pack, lead spacing F = 3.5 mm (for ∅ 8 mm)
- 008 = for taped leads, Ammo pack, lead spacing F = 5.0 mm (for ∅ 8 ... 12.5 mm)
- 009 = for taped leads, Ammo pack, lead spacing F = 7.5 mm (for ∅ 16 mm and d × l = 18 × 20 … 18 × 31.5 mm)
- 012 = for bent 90° leads, blister (for ∅ 16 … 18 mm)



Useful life[1)]

depending on ambient temperature T_A under ripple current operating conditions

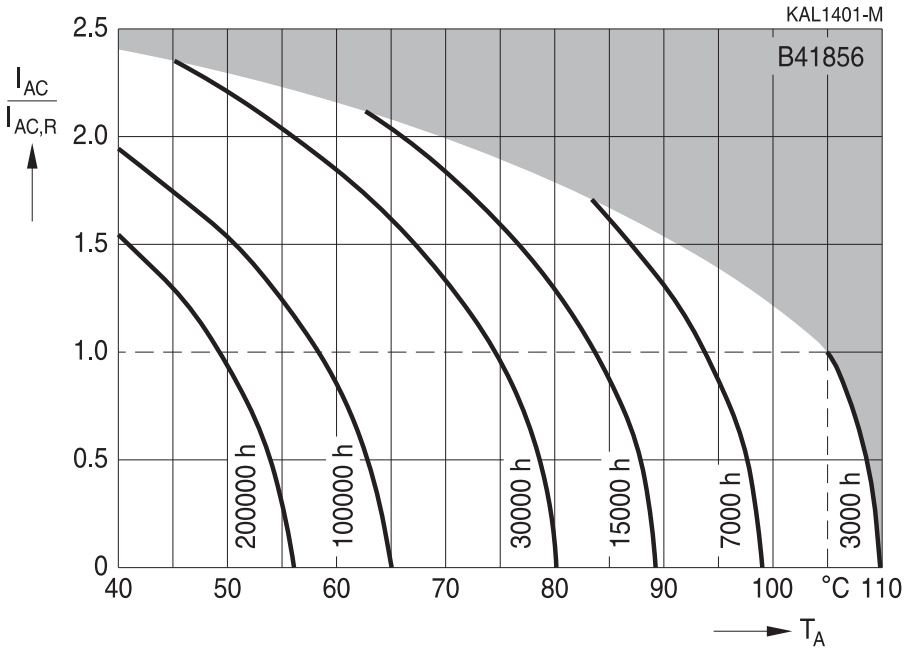
d = 8 mm



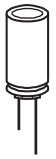
Useful life[1)]

depending on ambient temperature T_A under ripple current operating conditions

d = 10 mm



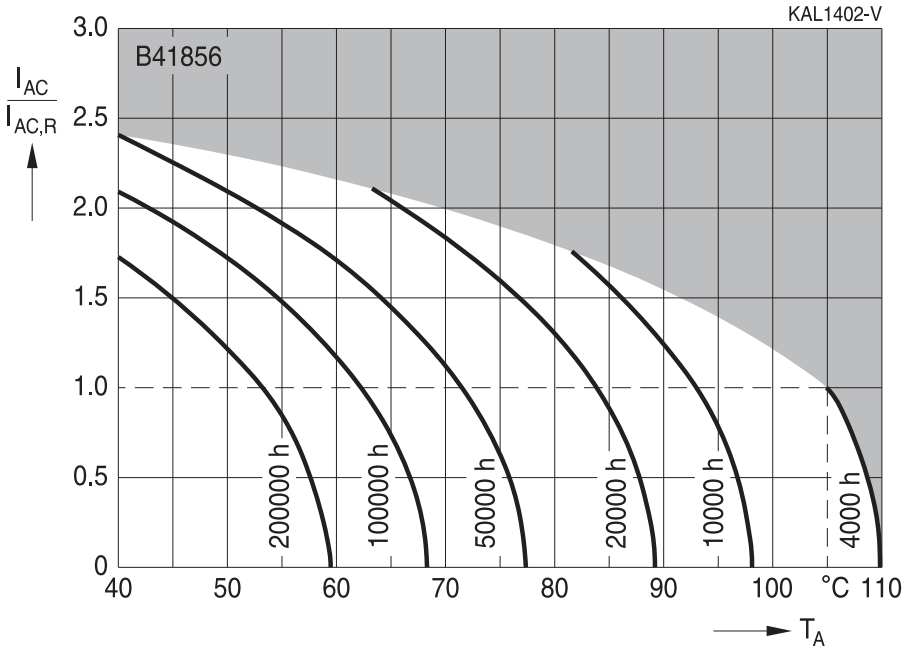
1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



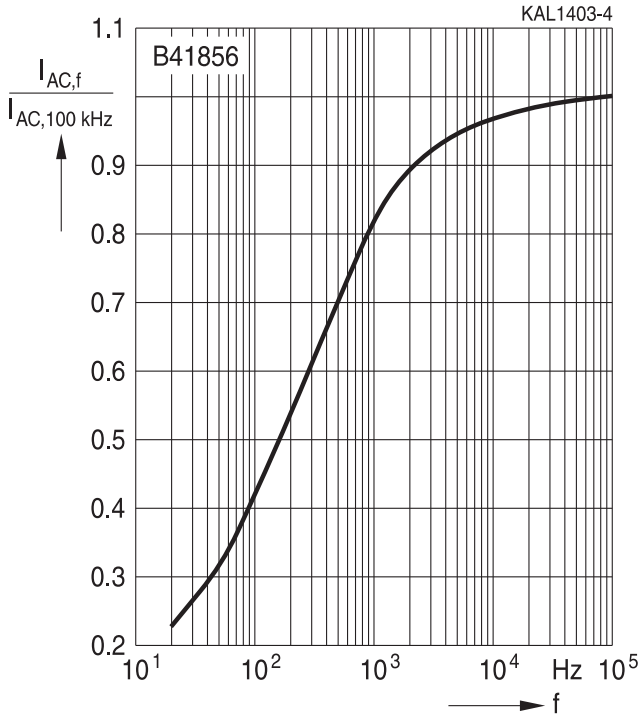
Useful life[1)]

depending on ambient temperature T_A under ripple current operating conditions

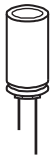
d ≥ 12.5 mm



Frequency factor of permissible ripple current I_{AC} versus frequency f



1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



Taping, packing and lead configurations

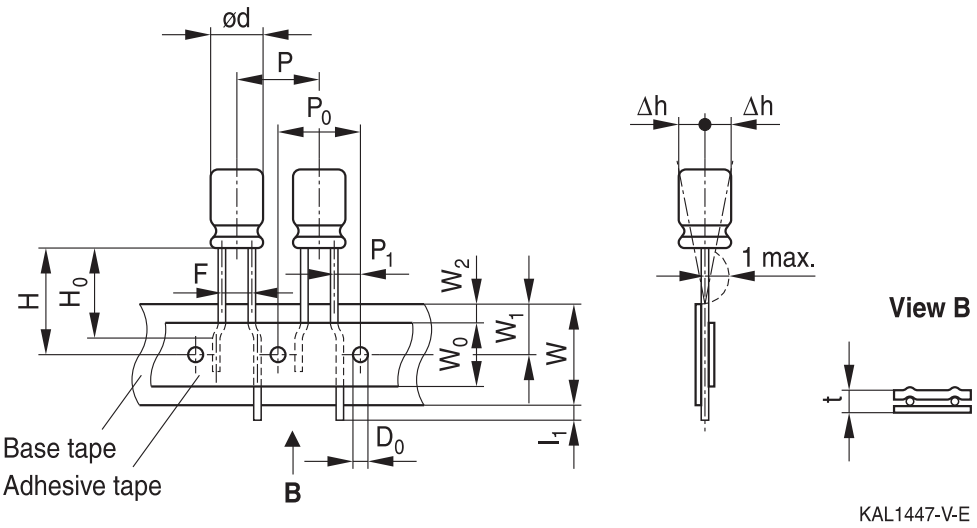
Taping

Single-ended capacitors are available taped in Ammo pack from diameter 8 to 18 mm as follows:

Lead spacing F = 3.5 mm (∅ d = 8 mm)
Lead spacing F = 5.0 mm (∅ d **=** 8 … 12.5 mm)
Lead spacing F = 7.5 mm (∅ d = 16 ... 18 mm).

The dimensions for F, P_1 and 1 max. are specified with reference to the center of the terminal wires.

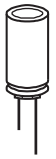
Lead spacing 3.5 mm (∅ d = 8 mm)
Last 3 digits of ordering code: 006



Dimensions in mm

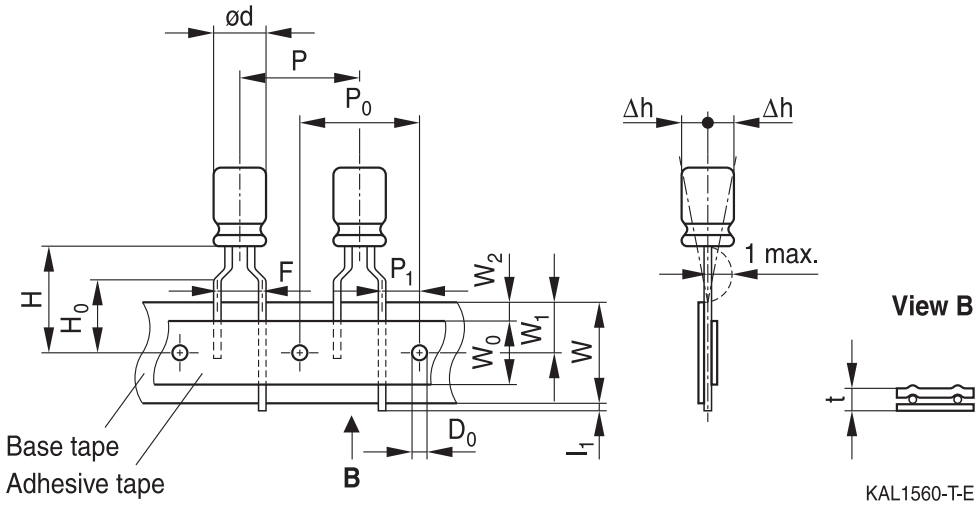
∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	I_1	t	Δh	D_0
8	3.5	18.5	18.0	9.5	9.0	3.0	12.7	12.7	4.6	1.0	0.7	1.0	4.0
Tolerance	+0.8 −0.2	±1.0	±0.5	min.	±0.5	max.	±1.0	±0.3	±0.6	max.	±0.2	max.	±0.2

Leads can also run straight through the taping area.



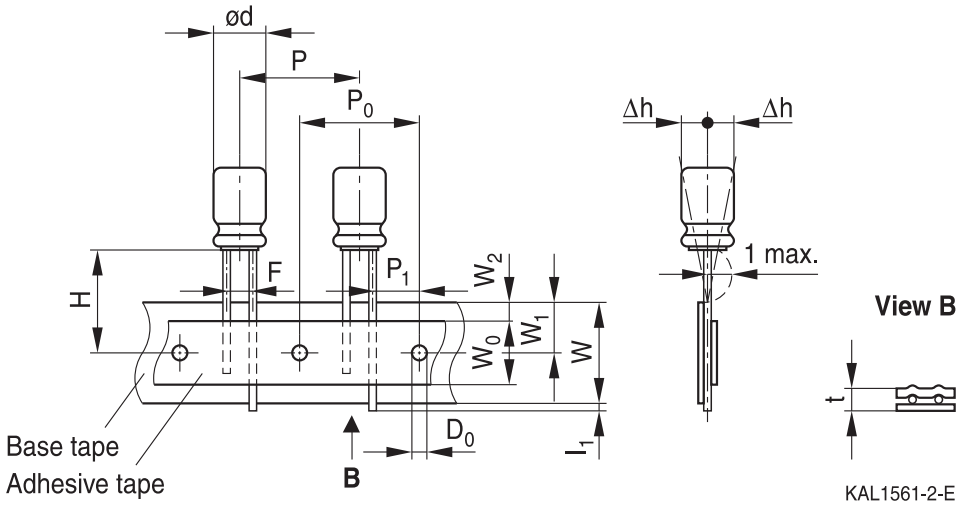
Lead spacing 5.0 mm (∅ d = 8 mm)

Last 3 digits of ordering code: 008



Lead spacing 5.0 mm (∅ d = 10 ... 12.5 mm)

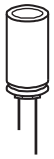
Last 3 digits of ordering code: 008



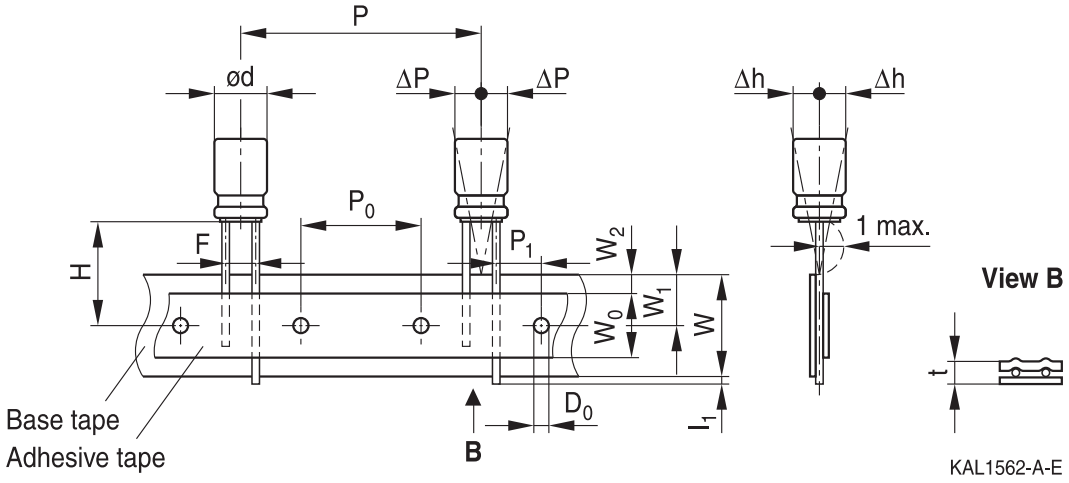
Dimensions in mm

∅ d	F	H	W	W_0	W_1	W_2	H_0	P	P_0	P_1	l_1	t	Δh	D_0
8	5.0	20.0	18.0	9.5	9.0	1.5	16.0	12.7	12.7	3.85	1.0	0.6	1.0	4.0
10		19.0		9.5			–	12.7	12.7	3.85				
12.5		19.0		11.5			–	15.0	15.0	5.0				
Tolerance	+0.8 −0.2	±0.75	±0.5	min.	±0.5	max.	±0.5	±1.0	±0.2	±0.5	max.	+0.3 −0.2	max.	±0.2

Taping is available up to dimensions d × l = 12.5 × 25 mm.



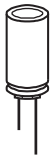
Lead spacing 7.5 mm (∅ d = 16 ...18 mm)
Last 3 digits of ordering code: 009



Dimensions in mm

∅ d	F	H	W	W_0	W_1	W_2	P	P_0	P_1	I_1	t	ΔP	Δh	D_0
16	7.5	18.5	18.0	12.5	9.0	1.5	30.0	15.0	3.75	1.0	0.7	0	0	4.0
18														
Tolerance	±0.8	−0.5 +0.75	±0.5	min.	±0.5	max.	±1.0	±0.2	±0.5	max.	±0.2	±1.0	±1.0	±0.2

Taping is available up to dimensions d × l = 16 × 31.5 mm and 18 × 31.5 mm.



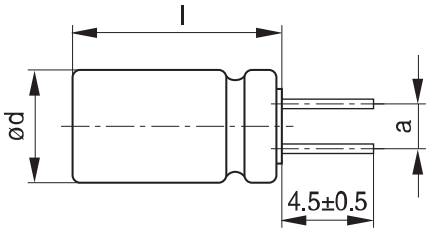
Cut or kinked leads

Single-ended capacitors are available with cut or kinked leads. Other lead configurations also available upon request.

Cut leads

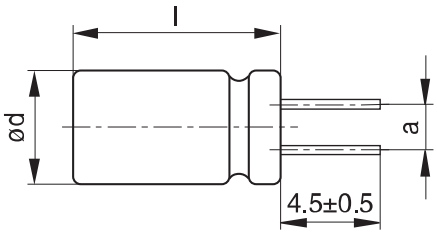
Last 3 digits of ordering code: 002

With stand-off rubber seal



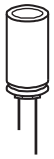
KAL1085-I

With flat rubber seal



KAL1086-R

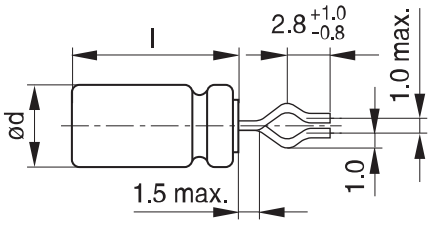
Case size d × l (mm)	Dimensions (mm) a ±0.5
10 × 12.5	5.0
10 × 16	5.0
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
16 × 35.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5



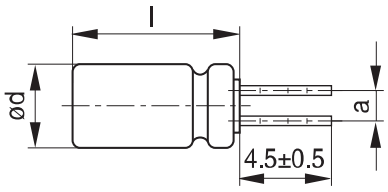
Kinked leads

Last 3 digits of ordering code: 001

With stand-off rubber seal

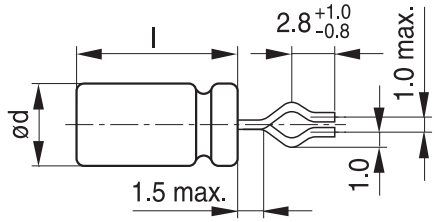


KAL1081-K

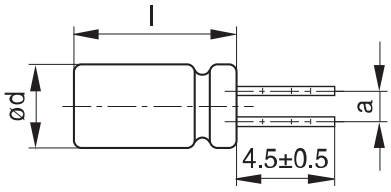


KAL1083-2

With flat rubber seal

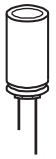


KAL1082-T



KAL1084-A

Case size d × l (mm)	Dimensions (mm) a ±0.5
10 × 20	5.0
12.5 × 20	5.0
12.5 × 25	5.0
16 × 20	7.5
16 × 25	7.5
16 × 31.5	7.5
16 × 35.5	7.5
18 × 20	7.5
18 × 25	7.5
18 × 31.5	7.5
18 × 35	7.5
18 × 40	7.5

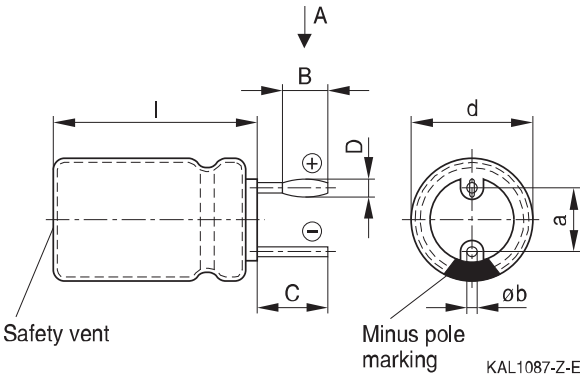


PAPR leads (Protection Against Polarity Reversal)

These lead configurations ensure correct placement of the capacitor on the PCB with regard to polarity. PAPR leads are available for diameters from 10 mm up to 18 mm (excluding d × l = 12.5 × 30/35/40 mm).
There are three configurations available: Crimped leads, J leads, bent 90° leads.

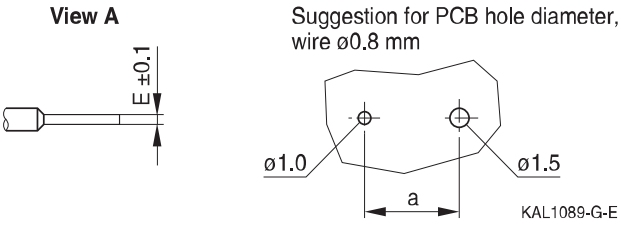
Crimped leads
Last 3 digits of ordering code: 003

With stand-off rubber seal

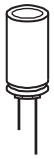


The series B41898 has no sleeve nor minus pole marking, the positive pole is marked on the aluminum case side instead.

Suggestion for PCB hole diameter

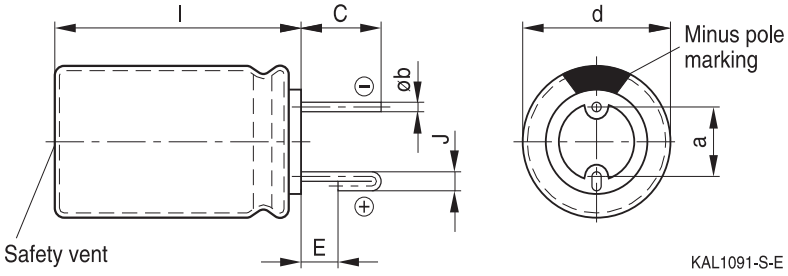


Case size	Dimensions (mm)					
d × l (mm)	B ±0.2	C ±0.5	D ±0.1	E ±0.1	a ±0.5	∅b
16 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
16 × 35.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.05
18 × 20	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 25	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 31.5	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 35	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1
18 × 40	1.5	3.0	1.3	0.3	7.5	0.8 ±0.1



J leads

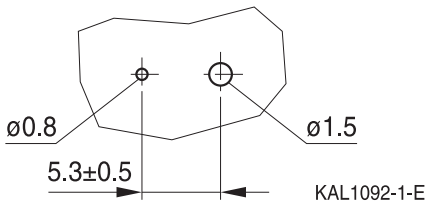
Last 3 digits of ordering code: 004



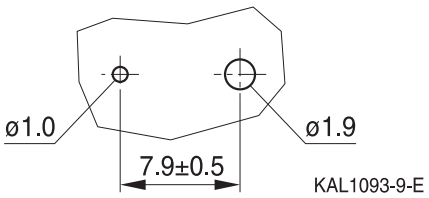
The series B41898 has no sleeve nor minus pole marking, the positive pole is marked on the aluminum case side instead.

Suggestion for PCB hole diameter

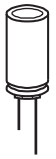
Suggestion for PCB hole diameter, wire ø0.6 mm



Suggestion for PCB hole diameter, wire ø0.8 mm

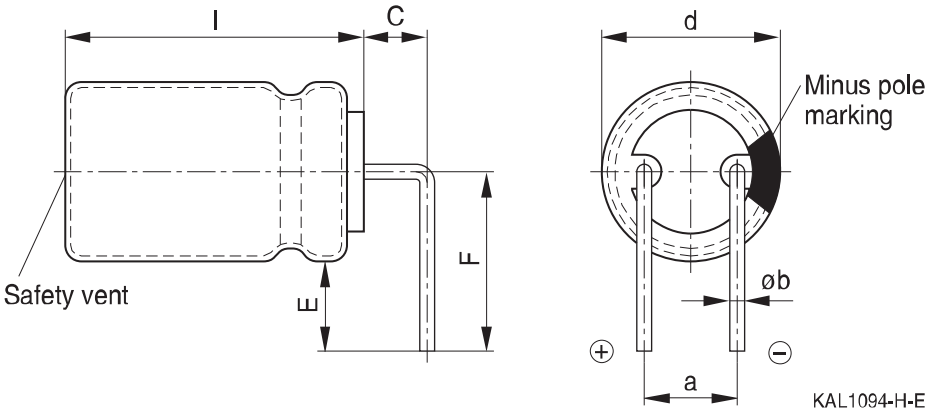


Case size	Dimensions (mm)				
d × l (mm)	C ±0.5	E ±0.5	J ±0.2	a ±0.5	∅b
10 × 12.5	3.2	0.7	1.2	5.0	0.6 ±0.05
10 × 16	3.2	0.7	1.2	5.0	0.6 ±0.05
10 × 20	3.2	0.7	1.2	5.0	0.6 ±0.05
12.5 × 20	3.2	0.7	1.2	5.0	0.6 ±0.05
12.5 × 25	3.2	0.7	1.2	5.0	0.6 ±0.05
16 × 20	3.5	0.7	1.6	7.5	0.8 ±0.05
16 × 25	3.5	0.7	1.6	7.5	0.8 ±0.05
16 × 31.5	3.5	0.7	1.6	7.5	0.8 ±0.05
16 × 35.5	3.5	0.7	1.6	7.5	0.8 ±0.05
18 × 20	3.5	0.7	1.6	7.5	0.8 ±0.1
18 × 25	3.5	0.7	1.6	7.5	0.8 ±0.1
18 × 31.5	3.5	0.7	1.6	7.5	0.8 ±0.1
18 × 35	3.5	0.7	1.6	7.5	0.8 ±0.1



Bent 90° leads for horizontal mounting pinning

Last 3 digits of ordering code: 012



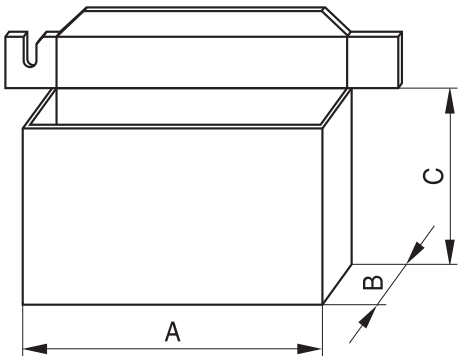
The series B41898 has no sleeve nor minus pole marking, the positive pole is marked on the aluminum case side instead.

Case size	Dimensions (mm)				
d × l (mm)	C ±0.5	E ±0.5	F ±0.5	a ±0.5	∅b
16 × 20	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 25	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 31.5	4.0	4.0	12.0	7.5	0.8 ±0.05
16 × 35.5	4.0	4.0	12.0	7.5	0.8 ±0.05
18 × 20	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 25	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 31.5	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 35	4.0	4.0	13.0	7.5	0.8 ±0.1
18 × 40	4.0	4.0	13.0	7.5	0.8 ±0.1

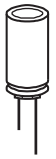
Bent leads for diameter 12.5 mm available upon request.

Packing units and box dimensions

Ammo pack



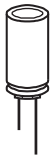
Case size d × l	Dimensions (mm)			Packing units
mm	A_{max}	B_{max}	C_{max}	pcs.
8 × 11.5	345	60	240	1000
10 × 12.5	345	60	280	750
10 × 16	345	65	200	500
10 × 20	345	65	200	500
12.5 × 20	345	65	260	500
12.5 × 25	345	70	260	500
16 × 20	325	65	285	300
16 × 25	325	65	285	300
16 × 31.5	325	80	275	300
18 × 20	325	65	285	250
18 × 25	325	65	285	250
18 × 31.5	325	80	275	250



Overview of packing units and code numbers

						PAPR		
Case size d × l mm	Standard, bulk pcs.	Taped, Ammo pack pcs.			Kinked leads, bulk pcs.	Cut leads, bulk pcs.	Crimped leads, blister pcs.	J leads, blister pcs.	Bent 90° leads, blister pcs.
8 × 11.5	1000	1000			–	–	–	–	
10 × 12.5	1000	750			–	1000	–	900	
10 × 16	1000	500			–	1000	–	675	
10 × 20	500	500			500	500	–	500	
12.5 × 20	350	500			350	350	–	300	1)
12.5 × 25	250	500			500	500	–	225	1)
12.5 × 30	200	–			–	–	–	–	
12.5 × 35	175	–			–	–	–	–	
12.5 × 40	175	–			–	–	–	–	
16 × 20	250	300			200	200	200	200	420
16 × 25	250	300			200	200	216	216	216
16 × 31.5	200	300			250	250	180	180	180
16 × 35.5	100	–			100	100	150	150	150
18 × 20	175	250			175	175	200	200	420
18 × 25	150	250			150	150	200	200	200
18 × 31.5	100	250			100	100	150	150	150
18 × 35	100	–			100	100	150	150	150
18 × 40	125	–			100	100	72	–	72
The last three digits of the complete ordering code state the lead configuration	**000**	Code	F (mm)	d (mm)	**001**	**002**	**003**	**004**	**012**
		006	3.5	8					
		008	5	8...12.5					
		009	7.5	16...18					

1) Available upon request



B41856

Low impedance – 105 °C

Cautions and warnings

Personal safety

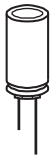
The electrolytes used by EPCOS have been optimized both with a view to the intended application and with regard to health and environmental compatibility. They do not contain any solvents that are detrimental to health, e.g. dimethyl formamide (DMF) or dimethyl acetamide (DMAC).
Furthermore, some of the high-voltage electrolytes used by EPCOS are self-extinguishing.

As far as possible, EPCOS does not use any dangerous chemicals or compounds to produce operating electrolytes, although in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no alternative materials are currently known. We do, however, restrict the amount of dangerous materials used in our products to an absolute minimum.

Materials and chemicals used in EPCOS aluminum electrolytic capacitors are continuously adapted in compliance with the EPCOS Corporate Environmental Policy and the latest EU regulations and guidelines such as RoHS, REACH/SVHC, GADSL, and ELV.

MDS (Material Data Sheets) are available on the EPCOS website for all types listed in the data book. MDS for customer specific capacitors are available upon request.
MSDS (Material Safety Data Sheets) are available for all of our electrolytes upon request.

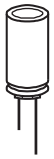
Nevertheless, the following rules should be observed when handling aluminum electrolytic capacitors: No electrolyte should come into contact with eyes or skin. If electrolyte does come into contact with the skin, wash the affected areas immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment. Avoid inhaling electrolyte vapor or mists. Workplaces and other affected areas should be well ventilated. Clothing that has been contaminated by electrolyte must be changed and rinsed in water.



Product safety

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of chapter "General technical information".

Topic	Safety information	Reference chapter "General technical information"
Polarity	Make sure that polar capacitors are connected with the right polarity.	1 "Basic construction of aluminum electrolytic capacitors"
Reverse voltage	Voltages of opposite polarity should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
Mounting position of screw-terminal capacitors	Screw terminal capacitors must not be mounted with terminals facing down unless otherwise specified.	11.1. "Mounting positions of capacitors with screw terminals"
Robustness of terminals	The following maximum tightening torques must not be exceeded when connecting screw terminals: M5: 2.5 Nm M6: 4.0 Nm	11.3 "Mounting torques"
Mounting of single-ended capacitors	The internal structure of single-ended capacitors might be damaged if excessive force is applied to the lead wires. Avoid any compressive, tensile or flexural stress. Do not move the capacitor after soldering to PC board. Do not pick up the PC board by the soldered capacitor. Do not insert the capacitor on the PC board with a hole space different to the lead space specified.	11.4 "Mounting considerations for single-ended capacitors"
Soldering	Do not exceed the specified time or temperature limits during soldering.	11.5 "Soldering"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Upper category temperature	Do not exceed the upper category temperature.	7.2 "Maximum permissible operating temperature"
Passive flammability	Avoid external energy, e.g. fire.	8.1 "Passive flammability"



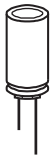
B41856

Low impedance – 105 °C

Topic	Safety information	Reference chapter "General technical information"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
Maintenance	Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the capacitors. Do not apply excessive mechanical stress to the capacitor terminals when mounting.	10 "Maintenance"
Storage	Do not store capacitors at high temperatures or high humidity. Capacitors should be stored at +5 to +35 °C and a relative humidity of ≤ 75%.	7.3 "Shelf life and storage conditions"
		Reference chapter "Capacitors with screw terminals"
Breakdown strength of insulating sleeves	Do not damage the insulating sleeve, especially when ring clips are used for mounting.	"Screw terminals – accessories"

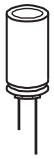
Display of ordering codes for EPCOS products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications and the website of EPCOS, or in order-related documents such as shipping notes, order confirmations and product labels. The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.
Detailed information can be found on the Internet under www.epcos.com/orderingcodes.



Symbols and terms

Symbol	English	German
C	Capacitance	Kapazität
C_R	Rated capacitance	Nennkapazität
C_S	Series capacitance	Serienkapazität
$C_{S,T}$	Series capacitance at temperature T	Serienkapazität bei Temperatur T
C_f	Capacitance at frequency f	Kapazität bei Frequenz f
d	Case diameter, nominal dimension	Gehäusedurchmesser, Nennmaß
d_{max}	Maximum case diameter	Maximaler Gehäusedurchmesser
ESL	Self-inductance	Eigeninduktivität
ESR	Equivalent series resistance	Ersatzserienwiderstand
ESR_f	Equivalent series resistance at frequency f	Ersatzserienwiderstand bei Frequenz f
ESR_T	Equivalent series resistance at temperature T	Ersatzserienwiderstand bei Temperatur T
f	Frequency	Frequenz
I	Current	Strom
I_{AC}	Alternating current (ripple current)	Wechselstrom
$I_{AC,RMS}$	Root-mean-square value of alternating current	Wechselstrom, Effektivwert
$I_{AC,f}$	Ripple current at frequency f	Wechselstrom bei Frequenz f
$I_{AC,max}$	Maximum permissible ripple current	Maximal zulässiger Wechselstrom
$I_{AC,R}$	Rated ripple current	Nennwechselstrom
I_{leak}	Leakage current	Reststrom
$I_{leak,op}$	Operating leakage current	Betriebsreststrom
l	Case length, nominal dimension	Gehäuselänge, Nennmaß
l_{max}	Maximum case length (without terminals and mounting stud)	Maximale Gehäuselänge (ohne Anschlüsse und Gewindebolzen)
R	Resistance	Widerstand
R_{ins}	Insulation resistance	Isolationswiderstand
R_{symm}	Balancing resistance	Symmetrierwiderstand
T	Temperature	Temperatur
ΔT	Temperature difference	Temperaturdifferenz
T_A	Ambient temperature	Umgebungstemperatur
T_C	Case temperature	Gehäusetemperatur
T_B	Capacitor base temperature	Temperatur des Gehäusebodens
t	Time	Zeit
Δt	Period	Zeitraum
t_b	Service life (operating hours)	Brauchbarkeitsdauer (Betriebszeit)



B41856

Low impedance – 105 °C

Symbol	English	German
V	Voltage	Spannung
V_F	Forming voltage	Formierspannung
V_{op}	Operating voltage	Betriebsspannung
V_R	Rated voltage, DC voltage	Nennspannung, Gleichspannung
V_S	Surge voltage	Spitzenspannung
X_C	Capacitive reactance	Kapazitiver Blindwiderstand
X_L	Inductive reactance	Induktiver Blindwiderstand
Z	Impedance	Scheinwiderstand
Z_T	Impedance at temperature T	Scheinwiderstand bei Temperatur T
tan δ	Dissipation factor	Verlustfaktor
λ	Failure rate	Ausfallrate
ε_0	Absolute permittivity	Elektrische Feldkonstante
ε_r	Relative permittivity	Dielektrizitätszahl
ω	Angular velocity; $2 \cdot \pi \cdot f$	Kreisfrequenz; $2 \cdot \pi \cdot f$

Note

All dimensions are given in mm.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

   We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply.**
7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System.** For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

Important notes

8. The trade names EPCOS, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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